

REMARKS

Applicant acknowledges with appreciation the specific instructions provided in the Office Action in order to overcome current rejections. Applicant has complied with these instructions as detailed below, and respectfully requests reexamination.

Claims 9-12 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for containing the term "improved". Claims 9-12 have been amended as suggested in the Office Action, and the term "improved" is removed.

Applicant respectfully requests this rejection be withdrawn.

Claims 1, 2, 4, 5, 7, 8, 10, and 12 were rejected under 35 U.S.C. 112, first paragraph and 35 U.S.C. 132(a) as containing new matter. Claims 1, 2, 4, 5, 7, 8, and 10-12 are amended as suggested in the Office Action, and as described below.

As suggested in the Office Action, Claims 1 and 2 are amended by replacing "refractory metal oxide" with "a refractory metal oxide alumina" as supported in the original claims and the specification (Application page 7 line 24 and page 8 line 7). Claims 4 and 5 are amended to delete alumina from the list of refractory metal oxides as supported in the original claims and the specification (Application page 9 ll. 4-7). Although alumina is a preferred embodiment of a refractory metal oxide used in the composition, the same effect can be obtained when particles of other refractory metal oxides such as zircon, magnesia, mullite, spinel and silica are used. Claims 1 and 2 were previously amended to reflect this general class of refractory metal oxides, while Claims 4 and 5 were amended to particularly claim the listed subset of refractory metal oxides, including alumina.

Claim 7 was rejected for missing the word "point" after melting as well as missing the limitation that a small amount of titanium is dissolved therein. Claim 7 is amended to include the word "point" as well as the limitation that a predetermined small amount of the titanium

from the elements listed in the claim dissolves and enables the formation of the high melting point protective layer (Application page 14 ll. 16-19).

Claim 8 was similarly rejected for omitting the term "point" and has been amended to include this term as well as the limitation that a predetermined small amount of the titanium from the elements listed in the claim dissolves and enables the formation of the high melting point protective layer (Application page 14 ll. 16-19). However, the Office Action also suggests that the specific language "formation of a high melting [point] protective layer is formed in the proximity of the refractory surface" is not supported by the disclosure as described in the last three lines of page 14 of the disclosure. Applicant respectfully clarifies that the cited portion of the disclosure is describing the results of a test analysis that shows the location of the protective layer as being in proximity to the surface of the carbonaceous refractory material (Application page 14 ll. 19-25). The analysis references the cross sectional view of Fig. 3 where the protective layer is formed at the interface between melted pig iron and the surface of the carbonaceous refractory material. The interface location in the cross sectional view of Fig. 3 demonstrates the protective layer is located on the surface of the carbonaceous refractory material. Claim 8 is further amended to include the location of the protective layer as on the carbonaceous refractory material surface (Application page 14 ll. 18-19 and ll. 24-25).

Claim 9 is amended to correspond with Claims 1 and 8 as amended to include the particular refractory metal oxides listed and to identify the location of the protective layer as on the surface of the carbonaceous refractory material.

Claims 10-12 are amended to remove the term "approximately".

Applicant respectfully requests this rejection be withdrawn.

Claims 1, 2, 4, 5 and 7-12 were rejected under 35 U.S.C. 103(a) as being unpatentable over *Watanabe et al.* ("Watanabe" U.S. Patent No. 4,306,030). Applicant respectfully traverses this rejection.

The present invention is drawn to a baked carbonaceous refractory material produced in a non-oxidizing atmosphere at a relatively high temperature of 1250 °C (Application page 18 ll. 11-13, page 18 line 25 to page 19 line 2, and elsewhere). In contrast, Watanabe is drawn to an unburned (unbaked) carbonaceous material that is merely heat treated in an oxidizing atmosphere at a relatively low temperature of 300 °C (Watanabe col. 4 ll. 29-31). Applicant submits that the term unburned in Watanabe is a term of art that is equivalent to the term unbaked (Watanabe col. 1 ll. 4-5). Watanabe discloses higher temperatures of 1000°C and 1400 °C, but these are in the context of an examination of the completed carbonaceous refractory materials (Watanabe col. 4 ll. 29-38). The differences between the non-oxidizing versus oxidizing atmosphere, and baking verses non-baking, yield refractory materials with significantly different properties.

When excess silicon is heated in an oxidizing atmosphere, silicon dioxide is produced even if the silicon compound includes carbon. On the other hand, when a silicon compound including carbon is heated in a non-oxidizing atmosphere, silicon carbide is produced. Silicon dioxide impairs the corrosion resistance of the refractory materials, while silicon carbide provides a partitioning effect in the pores by metallic silicon, and improves the corrosion resistance of the refractory materials so produced (Application page 9 ll. 13-21). Thus, the baked refractory material produced by the present invention is completely different from the unbaked refractory material produced by Watanabe, both in manufacturing method and the properties of the produced refractory material. Applicant respectfully submits that, since the methods of producing and the resulting properties of the refractory materials are different, the fact that both Watanabe and the present application disclose overlapping

amounts of metallic silicon 0.5->6% and 5-15% respectively, does not render either the methods or refractory materials obvious. Watanabe actually teaches away from any quantity of metallic silicon greater than 6% indicating the resistance of such a compound to melting loss is compositionally impaired (Watanabe col. 3 ll. 23-27). Further, as described in the present application, the partitioning effect in the pores by metallic silicon is insufficient for quantities of metallic silicon below 5% (Application page 9 ll. 13-16). Although Applicant does not believe that the Watanabe reference can render the present invention obvious, new Claims 13 and 14 are offered which limit the quantity of metallic silicon into the more narrow range of greater than 6% to less than and including 15%, which is distinguished over the range of metallic silicon described in the Watanabe reference (Watanabe col. 3 ll. 19-27).

Watanabe teaches that aluminum and/or magnesium powder are added in order to preclude cohesion between carbon and oxygen (Watanabe col. 2 ll. 15-25). Since the unbaked carbonaceous material described by Watanabe is both produced and used in an oxidizing atmosphere, the aluminum and/or magnesium are essential (Watanabe col. 1 ll. 23-50). In contrast, the carbonaceous materials of the present invention are both baked and used in a non-oxidizing atmosphere, and it is unnecessary to preclude cohesion between carbon and oxygen (Application page 16 ll. 2-7 and page 18 ll. 11-13). Regarding the present invention, the addition of aluminum or magnesium powder can actually be harmful rather than useful since these contributions could generate Al_4C_3 and MgC during baking which could react with water due to hydration, thereby making the baked carbonaceous materials fragile. Further, Watanabe teaches the addition of silicon to prevent the hydration of carbides through the combined use of both aluminum powder and magnesium powder that is distinct from the conventional use of added silicon (Watanabe col. 3 ll. 32-37). Preventing the hydration of carbides avoids structural deterioration (Watanabe col. 4 ll. 18-20). Therefore,

Watanabe teaches that it is necessary to combine metallic silicon with aluminum and/or magnesium powder in order to avoid the hydration of carbides. This technique of combining metallic silicon with aluminum and/or magnesium powder is completely different from the present application which teaches using metallic silicon independently as claimed (Application page 18 ll. 1-4, page 20 Table 1, and others).

The present application discloses alumina (Al_2O_3) content in an amount that is limited to 15% or less in order to prevent the corrosion of the interface between melted pig iron and slug (Application page 8 line 25 to page 9 line 4). In contrast, Watanabe teaches alumina content of 77-80% that is clearly distinguished from the present application (Watanabe col. 5 Table 1-continued).

The attached figure A1 shows the measured X-ray diffraction peak intensity ratio of Ti_3O_5 from the face (200) to the face (111) is 1.7% for the conventional titanium carbide material as taught by the Watanabe reference. Attached figure A2 shows the measured X-ray diffraction peak intensity is less than 1% for the titanium carbide material of the present invention as claimed. Applicant respectfully submits that it is not an inherent property of Watanabe to exhibit the measured X-ray diffraction peak intensity ratio of Ti_3O_5 from the face (200) to the face (111) of less than 1% as claimed in the present invention. Applicant is willing to submit further evidence of the X-ray diffraction peak intensity ratio differences between the refractory materials produced by the process described by Watanabe as distinguished from the present invention.

In conclusion, Applicant submits that the baked carbonaceous refractory material of the present invention that is produced at a relatively high temperature in a non-oxidizing atmosphere is clearly distinguished from the unbaked carbonaceous material that is merely heat treated in an oxidizing atmosphere at a relatively low temperature based on the above arguments. Further, the X-ray diffraction peak intensity ratio as claimed is not an inherent

property of Watanabe or a conventional titanium carbide material based on the above arguments and as shown in Figs. A1-A2.

Independent Claims 1, 2, 9, 13 and 14 are hereby distinguished over the Watanabe reference. Claims 4, 5, 7-12 depend from and further limit the independent claims.

Applicant respectfully requests this rejection be withdrawn.

It is believed that all claims are in condition for allowance, and an early notification of the same is requested.

If the Examiner believes that a telephone interview will help further the prosecution of this case, he is respectfully requested to contact the undersigned attorney at the listed telephone number.

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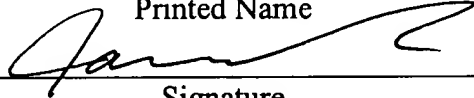
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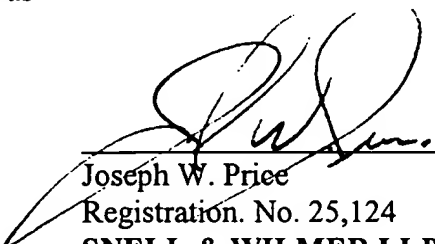
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